PL quantum yield of SWCNTs: photon reabsorption effect

Hiromichi Kataura, Xiaojun Wei, Mayumi Tsuzuki, Guowei Wang, Yohei Yomogida, Atsushi Hirano, and Takeshi Tanaka

NMRI, AIST, Higashi 1-1-1, Tsukuba, Ibaraki 305-8565, Japan

Photoluminescence (PL) from single-wall carbon nanotube (SWCNT) has been often used for its structural identification without consideration of reabsorption of the emission. In order to derive the correct content rate of the spices of specific chirality, it is at least necessary to know the quantum yield of each chirality. In the PL of SWCNT, furthermore, since Stokes shift is small, the photon reabsorption effect is dominant and the apparent PL spectrum shape and emission intensity are greatly modified depending on its concentration in the used SWCNT dispersion. This problem makes quantitative identification of SWCNT by PL intensity difficult. In this study, concentration dependence of the PL of SWCNT separated into a few chirality was analyzed in detail including the effect of the photon reabsorption [1]. Surprisingly, all changes in the PL spectrum occurring in the high SWCNT concentration range can be explained simply by the reabsorption effect and there were no further influences caused by interaction between SWCNTs that were suggested in the previous studies. We have obtained PL quantum yield derived from the emission intensity corrected from the photon reabsorption effect. They varied highly depending on the chirality of SWCNT, which agreed well with theoretical report [2] where the LO phonon relaxation process from E_{22} to E_{11} is dominant.

[1] X. Wei *et al*. in preparation.
[2] Y. Oyama *et al*. Carbon **44**, 873 (2006).